

THE
R E P O R T
OF
JOHN TRAIL, ENGINEER,
CONCERNING THE
PRACTICABILITY and EXPENCE
OF COMPLEATING THE
G R A N D C A N A L
FROM

DUBLIN to TULLAMORE in the KING's-COUNTY, and
making the MAIDEN and BRUSNA Rivers Navigable from thence to the
River SHANNON;

WITH
Collateral Cuts to the Rivers BARROW and BOYN, &c.

A D D R E S S E D
To the RIGHT HONOURABLE the
LORD-MAYOR, SHERIFFS, COMMONS and *Citizens* of the
CITY of DUBLIN,

By whose Order the SURVEY was made, and REPORT published,

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THE
LORD-MAYOR, ALDERMEN, AND COUNCILLORS
OF THE CITY OF LONDON

REPORT
OF THE

JOHN TRAIL, ESQ.



OF THE
BRITISH MUSEUM

GRAND

THE

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INTRODUCTION.

TIME will not permit me, nor indeed is it my inclination, or business, (as a practical Engineer,) though it may be expected, to introduce a Report with descriptions of Works similar to that which I was sent to examine, or to fill Pages with Matter, calculated solely to induce the Publick either to think me ingenious, or a useful Member of Society. There are few Canals or Rivers made navigable in Europe, of which, I could not, from my own knowledge, give a particular description, with the Works used in making them so; but as that can answer no other purpose than to serve me either to copy, or improve upon when occasion shall offer, I must beg leave to decline drawing inferences from them, unless as Precedents for what may hereafter be proposed.

Nothing need be said in favour of INLAND-NAVIGATION, the general advantages attending it, have almost every where been fully experienced, and are universally allow'd, and none of the modern Schemes or undertakings for this Kingdom's improvement, (in my humble opinion) are worthy of being put in competition with that of our Harbours, and extension of our NAVIGATION Inland, nor have any Propositions been made for either of those purposes, that can redound so much to the public benefit, as the completion of that Canal, which is the Subject of the following Sheets.

This is generally allowed, but doubts have arisen whether that Line hath been plan'd and proposed with Judgment; some imagine the Nation unable to furnish a Sum sufficient to compleat it, while others

others think it totally impracticable. To obviate therefore these Objections, was the purport of the Order given me, and which I have enabled myself to do, by a particular examination of the different Stratas of the Earth, and carefully taking the Levels and bearings of the Country, through which it is intended to be carry'd.

Several Surveys I find have been taken of this Tract, and Reports laid before PARLIAMENT, as well as the Honourable Board of COMMISSIONERS, for promoting and carrying on an INLAND-NAVIGATION, by whose Orders they were made, and in whose possession I have reason to believe they are in at present, as three Honourable Members of that Board, proposed to procure for me, all the Papers, Drawings, &c. that have been made of that Line, imagining they might save trouble in making my necessary Field Observations, and in the formation of my Report, as a Gentleman sent out by them on the same Errand a few months before me, had earnestly sought after and obtained them. This I declined accepting, tho' under the greatest obligations to those Honourable Gentlemen for their kindness,) as improper, even to entrust me with those Papers, which should be produced only to confirm, or confute, any part of my Report; nor would it be generous in me who had received an Order as unlimited as that given to any of those Gentlemen who have gone before me, to seek for any other assistance than that which is always thought sufficient for a practical Engineer, *viz.* good Instruments, the Field, and a competent Skill in his Profession.

Here I shall observe with regard to the process of this extensive Survey, that, as it is of the utmost importance as well to the Nation in general, as to the City of Dublin, for the sake of accuracy, I procured two Air Levels, with Telescopes, one three Feet, the other two Feet in length, that if one should by any accident vary from the Truth, the other might discover it, before I should be led into Error;

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error; and further to avoid the mistakes common to the most expert practitioners, by the contraction and expansion of the Bubble, I had a method for bringing it to its true situation, without relying upon the Eye for a 16th or 24th of an Inch, as is the common practice, and by which, in this climate where the weather is so changeable, Levels cannot be taken, but by chance, with any degree of justice.

Thus provided, I commenced upon my Survey, beginning at the City Basin, I continued to make proper observations on that part of the Canal already begun, taking the levels of the bottom, and surface of the adjacent Ground, with the altitude of the Banks, &c. When I found any part of the Country more favourably circumstanced for a CANAL than the present Tract, I diverted my course to examine it; but upon considering in what forwardness it is, and the expence that would attend the purchasing and breaking up fresh Ground, with other inconveniencies, I find no reasons sufficient to induce me to advise a deviation from the present Line, so far as the Ground is broken; tho' at the same time there are several places between Dublin and the Bog of Allen, where it might have been carry'd with greater propriety, and at less expence. In the Bog I was particularly attentive to its depth, and the consistence of the Strata which runs under it, and these Rivers which rise in the Bog, as well as every other River which I had occasion to pass in the course of this Survey; I had the good fortune to see and examine, after a series of fair Weather, when they were exceeding low; and that I might be the better acquainted with them on the other hand, I returned to view them after an incessant Rain of three Weeks.

From Tullamore I continued, agreeable to my order, to follow the course of the Maiden or Tullamore River, to its junction with that of the Brusna, which I also followed to where it enters the River Shannon, about

about two Miles above Banagher. On my arrival at Tullamore, I found these Rivers (by what I could learn from people who reside contiguous to them) as high as they had been known for many Years. I embraced this favourable opportunity to make such remarks on them as were necessary, while in their most destructive state; and after some Weeks, finding them subside, I began a very particular Survey, not only taking the levels and bearings of them, but also the exact dimensions of their Beds, their various depths, and the extent of the Valey through which they run; and as their bottoms are in some places Rock, in others loose, trundling Stones, Gravel, Sand, and different sorts of Clay, I made my remarks accordingly, and which I have endeavoured to express in as explicit a manner as possible in my large Plan of those Rivers.

Thus have I given a relation of the methods taken to obtain such materials as might enable me to answer the questions generally put to an Engineer on the like occasion, and which I am humbly of opinion are simply these: Is it practicable? At what expence? and what advantage will arise to the Undertakers, or the Publick, from its completion? The two first I have maturely considered, and have thereupon given my opinion in the following sheets, without paying the least respect to that of any other person whatsoever. The last, tho' self evidently great, and not the business of an Engineer, I would have gladly entered into more deeply than my time would permit. And indeed there are several other matters which I have been under the necessity of omitting, having had only five days after finishing my drawing for making out my Report, and which I shall prepare as soon as possible to add to it.

I have strictly confined my observations within the limits of my order, not proposing or offering new matter for consideration. For although

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though in a country so capable of an extensive Inland-Navigation as this is, Schemes practicable and profitable might be formed and laid on Paper in a few Months, that would require ages to execute; yet I cannot help thinking, that making the GRAND-CANAL compleatly navigable, with the Rivers Shannon, Barrow and Boyn, and their intended communications, to be at present only worthy of national attention; the other works that have been proposed, or begun in this Kingdom, are only secondary, being local, confined to some particular County or District, or for the use of some Town or Village, while they will diffuse their benefits over the whole Island, joining the principal Cities in it together, by a safe communication, and a speedy conveyance for the necessities of life, and articles of Commerce, which they are constantly exchanging with each other, as well as with the Inhabitants of the interior parts of the Country.

B

though in a country so capable of an extensive Inland-Navigation as this is, Schemes practicable and profitable might be formed and laid on paper in a few Months, that would require ages to execute; yet I cannot help thinking, that making the Grand-Canal completely navigable, with the Rivers Shannon, Barrow and Boyne, and their intended communications, to be at present only worthy of national attention; the other works that have been proposed, or begun in this Kingdom, are only locally, being local, confined to some particular County or District, or for the use of some Town or Village, while they will diffuse their benefits over the whole Island, joining the principal Cities in almost together, by a safe communication, and a speedy conveyance for the necessities of life, and articles of Commerce, which they are constantly exchanging with each other, as well as with the Inhabitants of the interior parts of the Country.

GENERAL DESCRIPTION

OF THE

CANAL,

Where **BEGUN**, and the **LINE** in which it is intended
to be **CONTINUED**.

IT is a general maxim with Engineers, in a design of this nature, to seek for the most direct passage, unless they find it necessary to vary their course for the accomodation of any particular place, whereby Trade may be increased, or other advantages arise to the undertakers, or the publick, or to avoid inconveniencies that may enlarge the expence, or impede the work in its execution. This general rule hath been strictly follow'd in laying out the Tract for the CANAL, even in some places, without observing just and strong causes for a deviation.

BUT to enter upon the description, I shall begin at the City-Bason, (for the altitude, rise, and fall of the Ground, number and situation of the Locks, I refer to the Profile, where they are particularly expressed, and visible on the slightest inspection;) from thence we pass in a right Line, with the greatest propriety, to the Lands of Clondalkin, about three Miles, in which, tho' the ascent seems to be gradual, it rises more than half the altitude of the point of partage. By winding the course of the Canal even in this short space, the rise might have been made something more gentle; but as the point of highest altitude could not be alter'd, the same Lockage would be necessary, and an extra expence in digging, and waste of Ground incurred thereby. And so far from disapproving, of crowding the Locks one on top of another, (to use the expression of a Gentleman who has had the honour of being employ'd as an Engineer in this Kingdom,) it would give me the greatest pleasure, was it in my power, to lock up the whole fall in one flight, as in every case of the kind it would add to the permanency, while in most it would save more than one fourth of the expence. The Plan for passing the Valley of Blue-Bell River I approve of, but

B 2

that

Engineers seek
for the short-
est Passage.

The freight-
Line too much
preserved.

Best Linetaken
to Clondalkin.

Great rise in
3 Miles.

Where Locks
can be joined
is an advan-
tage.

The Vale of
Blue-bell Ri-
ver.

A REPORT on the Practicability, &c.

Valley on the
Lands of Bal-
lyfarmot.

A Lock finish-
ed.

Mill-town Ri-
ver.

The Canal
ought not to
be kept at an
equal Breadth.

Insufficient
slope remedied

A Lock finish-
ed.

A Mistake in
the Level.

Rectified.

Carrying the
Canal through
the Hill of
Goller's-town
an advantage.

that part must be fortified, both with Earth and Masonry, before I can call it finished. There is also a Valley with a little Rill of Water in it, over which the Canal passes on a small Aqueduct, on the Lands of Ballyfarmot, where some additional banking is also necessary. On the Lands of Clondalkin there is one Lock ready for the Gates, and another in great forwardness. From thence the Canal runs upon a level 2949 Yards through Clonburrows and Grange to Ballykealy, crossing on an Aqueduct Mill-town River. On this, as well as on every other Level where the Canal is raised above Soil, too much regularity hath been observed, by keeping it at an equal breadth, whereby, Earth sufficient to raise the Banks could not be got between them, therefore to save trouble, they dug away the natural Ground on the outside for that purpose, by which means the Banks are left naked, with a very insufficient slope; in some places raised above Soil upwards of twenty Feet; however, this may be remedied conveniently, when the surplus Earth of one place, can be transported by Water to another where it is needful. There is on the Lands of Ballykealy a Lock also ready for the Gates, but by some means or other a mistake has been made in this Level of 2 Feet 3 Inches. The Arch of Mill-town River Tunnel, and the lower Sill of the Lock at Ballykealy, being so much higher than the upper Sill of that at the Tail of the Level, on the Lands of Clondalkin.

THIS difference I would propose taking off, by raising the Water on the Breast of the lower Lock, which will be attended with little or no expence, nor can it, as things are situate, with any bad consequence.

FROM the last mentioned Lock at Ballykealy, the Canal runs through the Hill of Goller's-town, (commonly called the Great Quarries,) about 2600 Yards. This Hill contains an almost inexhaustible fund of very excellent black Lime-Stone, of a most solid and durable nature; and tho' the carrying the Canal through this Mountain of Stone, (as some call it,) be by many attributed to a blunder of the Engineer, I should have look'd upon it as blundering, had he endeavoured to avoid it; and indeed the great advantage that will arise from it to the work while executing, and to the Proprietors and the publick, when the Canal is perfected, must be manifest to any Person who will reflect but for a moment. Let us consider the vast quantity of Stone and Lime that will

will be wanting for the Works necessary in the completion of the Canal, and that by taking the advantage of Water Carriage, (which by proceeding in a regular manner, may be obtained in one Month,) in transporting them to where they will be wanting, we shall be able to serve ourselves at about one fourth the expence they could otherways be procured for; and besides what is necessary for the Canal, I am certain when a Water conveyance can be had from that quarter, the City of Dublin may be supplied for ages, with rough Stone for building, at 2s. or 2s. 2d. per Perch, Ashlers at 3s. 6d. and Lime at 6d. per Hoghead, for which the present lowest price is 4s. 8s. and 1s. and the difference in the prices of those articles, I am confident would be much greater, especially in that of Lime, as Fuel will then be procured on more reasonable terms, the price thereof being at present greatly enhanced, by a tedious Land Carriage.

FROM the Hill of Goller's-town, the same Level is continued through the Commons of Hazle-hatch, to Clonaughles, where there is a Lock finished and the Gates hung; but for want of care the Swing-beams, and other parts of the Gates are rotten and mouldering away. In this Level also a mistake hath been made of 4 Feet 6 Inches, the under Sill of the upper, as in the last Level, being higher than the upper Sill of the lower Lock. This fall I would propose taking off, by adding another Pair of Gates to the upper Lock. It may be done by a distinct double Lock, in any part of the Level, but as that would incur an unnecessary expence in Masonry, and four Pair of Gates, where three are sufficient; besides raising the Canal more out of Ground where it is already too much, I prefer the first method; though there may be some cube Yards of digging at the Tail, and the Crown of a small Tunnel to be made somewhat lower; yet it will throw the Canal so much in Ground, take off a great and unnecessary pressure from slender made Banks, add permanency to the upper Lock, and lastly, will be an immediate saving in the execution, as well as hereafter, in supporting and repairing.

FROM Clonaughles the Canal is cut about 1000 Yards through beds of hard Stone, which, upon calcination, proves the best Lime I ever saw, and makes a Mortar for Water-works, little inferior to Terrace; a great quantity of this Stone is piled upon the Banks, for the use of the Work. It is then continued upon the same Level to the Lands of Barrenrath,

A Lock finished.

A mistake in the Level.

Method to rectify it.

Excellent Lime-Stone.

Little Morrel
River.

Barrenrath, where it crosses a small River call'd the Little Morrel, on an Aqueduct Bridge of three Arches, which through the inattention of the Workmen to the assign'd Altitude, or some other cause, is raised upwards of two Feet above the Line of Level; but as the Site of this Aqueduct is improperly chosen, there will be two great ends answered in taking it down; first, lowering it to the Level, and secondly, by placing it about 30 Feet further up the Canal, the current will be directed by its natural channel to an equal and free passage through each of the three Arches, whereas at present, it falls directly on the outside Peer of the Arch next the West, and being pretty powerful, especially in time of Floods, has sap'd its Foundation in such a manner, that it cannot stand long.

Aqueduct too
high.

Big Morrel.

ABOUT 2400 Yards from the Little Morrel, is another River of the same name, but hath the appellation of Big, as being something larger than the other, over which I propose carrying the Canal on Arches.

River Liffy.

FROM thence through the Lands of Cardiff's-town, Sallin's, and Osher's-town, 4777 Yards to the River Liffy; this River is well known to be subject to great and sudden Floods, and at the place where I propose the Canal to pass it on an Aqueduct Bridge, it rises sometimes 7 Feet perpendicular, and yet is so circumstanced, that it will be attended with no kind of difficulty, even the swell may be kept within the compass of, at most, 3 Feet, without any considerable rapidity.

PASSING the River Liffy, we continue our course through the Lands of Water's-town, to a place call'd Aughpadien; here the Ground for about 2300 Yards is neither broken, nor (as I am informed,) purchased. From Aughpadien the Canal is cut in the Lands of Landan's-town, and thro' the Hill of Downings 5325 Yards, to the entrance of the Bog of Allen.

Hill of Down-
ings.

THE matter of the Hill of Downings is a loose, sandy Gravel, of a running nature, and the depth of the Level for passing it being in some places upwards of forty Feet under Soil, I propose carrying the Canal 1758 Yards in a subterraneous Tunnel or Vault under Ground, with proper conveniencies for Light and Air, &c. This may be done with great facility, and I am certain it is the most permanent, and least expensive method by which this part of the Work can possibly be effected.

To be arched

Here

Here, as I already observed, we enter the Bog of Allen, which we traverse about twenty-four Miles three Quarters, touching in some places very conveniently the *Terra Firma*, as at the Wood of Allen, and Lullamore in the County of Kildare; Killcomber, Philip's-town, Nockballyboy, Ballycommon, Ballyteague, and lastly Tullamore in the King's-County. This Line intersects in the Bog some small Rivers, whereof the principal is first the Black wood River, which taking a serpentine course of about fourteen Miles through the County of Kildare, enters the River Barrow a little above Monestareven. The next are those of Cushaling and Figuile, which after passing our Line about a Mile and half unites, then continues warbling about four Miles, to where they drop into the Blackwood River, about two Miles from the River Barrow.

Bog of Allen.

Rivers intersected in the Bog. Blackwood River.

Cushaling and Figuile Rivers

THESE Rivers are naturally Navigable for small Boats, in which the miserable Inhabitants of the Bog carry Fern-Ashes, Char-Coal, and Timber, which they find in the Bog, under Soil, to Portarlinton and other places on the Banks of the Barrow.

Naturally Navigable.

IN this, at present, almost inaccessible Bog, is the point, or points of highest Altitude, and consequently here must the Canal, or Canals of Partition be; and I do not find any difficulty through the whole, that is not surmountable with ease and pleasure, provided that the proceedings be regular and judicious, and the assistance which nature hath kindly furnished us with be sought after, and properly apply'd. Time will not permit me to enlarge upon the subject, I therefore refer for a more particular View of my Design, (which I am of opinion differs widely from any hitherto laid before the Publick,) to my Profile and Map of the Country. Here I must observe that the Bog has been open'd from the Wood of Allen to Killcomber, and in some places carry'd twelve Feet in Ground, which hath had so good an effect upon it, as with the most trivial improvement to be rendered tenantable; and had this part of the Work been under the care of some attentive Person, from its first opening, it would have saved time, and some hundreds of Pounds in its completion.

Points of Partition.

Canal cut in the Bog.

BEING arrived at Tullamore, we enter the Maiden, or Tullamore River, which running in an open Valley about six Miles, falls into the River Brosna, and together they continue their course by Ferbane and Moystown

Maiden and Brosna Rivers

May be made
Navigable.

Moystown, to the River Shannon. These Rivers are naturally Navigable for some Miles in different places, and tho' I have had neither time to make out a Profile, or to give a Description of them, yet I have enabled myself, by a very particular Survey, and minutely making the necessary observations, to declare it practicable to make them permanently Navigable, at least by their assistance, to make a Navigable communication between Tullamore and the River Shannon, for I have propos'd to make Canals in several places [See my large Plan of those Rivers,] for passing such obstructions, as I found removing them would be attended with difficulty, hazard, or an extraordinary expence. And tho' the Valley be in some places contracted, yet such contraction will be no hinderance or detriment to any of the proposed Cuts, and the Mills which are upon the Rivers will rather receive benefit from, than injury by them. I shall further observe, that from Tullamore to the Shannon

Mills will not
be injured.

	M.	F.	P.
The Rivers measure by the Loops — — —	22	2	18
And by the intended Canals — — —	18	6	19

Another Passage to the
Shannon.

Yet notwithstanding I am of opinion, but cannot speak with any manner of certainty, as I sought for no other information, than a simple view of the Country, that a more favourable passage may be found, keeping to the South of Tullamore, by Lough-pallis, and passing a considerable way through the Bog, to enter the Shannon at or near Banagher.

Two Canals of Partition
absolutely necessary.

No additional
expence in
Lockage.

HAVING given a general description of the Grand Line, it now remains to say something with regard to the collateral Cuts of communication between it and the Rivers Barrow and Boyn. And first I shall observe, that finding it (in my humble opinion,) absolutely necessary to have a low center Level, consequently two summit Levels, or Canals of Partition, as in the Profile; it may be imagin'd, that an additional expence will be incur'd thereby in the article of Lockage; but (without saying it is otherwise impracticable to complete the Canal,) that does not hold good; for suppose it possible to continue the Canal of Partition through the Bog, from the first point of highest Altitude in the Hill of Downings, it would be in Soil at the end of twenty-two Miles; and indeed a Level of such extent is exceedingly desirable. I ~~say~~ suppose it could be attained, there would remain on each side a fall
to

Of the GRAND-CANAL.

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to the Barrow and the Boyn, to Lock up, equally expensive; besides, there would be very costly Works necessary, in passing Cusshaling and Figuiel Rivers, with extra Banking in several places, which by this Scheme will be saved, and the Canal brought down to a permanent and solid bed.

HARBOURS in convenient places will be wanting, where the Vessels may lie in safety, to deliver, or receive their loading, without obstructing the Navigation; and as some Gentlemen seem'd desirous of knowing, whether a Cut could be carry'd from the Canal to John's-town, or Naas, in the County of Kildare, so that the Trade of those Towns might be accommodated, Harbours made, and Ware-houses and Wharfs established there, for the conveniency of the more remote parts of the Country on that side.

Harbours will be wanting.

I took the Levels, &c. and find no difficulty in making such Cuts, for a sum not exceeding my estimate. But I must observe with regard to the Cut proposed to John's-town, that, besides accommodating the Country, we can there conveniently intercept the Morrel River, and from it receive an additional supply of Water for the Canal, which will be necessary, as the Blackwood River is not sufficient for that purpose. This may be thought strange by some, as I have heard said, that the Blackwood River would supply three such Navigations; however, practice and experience convince me to the contrary; and I would have Gentlemen who think so, consider the various causes of consumption; as a constant leakage through the Gates, the ouzing and soakage of the Banks, where raised above Soil; the exhalation of the Sun, the expence of it in passing Vessels through the Locks, and lastly, the regulating Water; for which purpose, I have great reason to believe, as much will be wanting for the Navigation of the Grand Canal, from Dublin to the Bog of Allen, as is sufficient to answer all the foregoing purposes. And as I have proposed two points of Partition, it naturally follows, that there must be a quantity of Water brought to each, to ballance the constant consumption; for which (as shall be hereafter shewn,) I have made ample provision. [For the direction of the Collateral Cuts, see my Map of the Country.]

Cut to John's-town.

The Blackwood River not sufficient for the supply of the Canal.

Water must be brought to both points of Partage.

C

SOME

SOME

GENERAL PROPOSITIONS.

Size of the
Vessels proper
for the Canal.

Of the Locks.

Dimensions of
the Canal.

Tunnel of the
Hill of Down-
ing.

THE dimensions of the Locks, must be in proportion to that of the Vessels intended to ply upon the Canal, and I shall suppose them to be 70 Feet long, Stem and Stern, 15 Feet wide, drawing five Feet Water, and carrying from 50 to 60 Tuns. This size I look upon to be the most portable, and best adapted to a Canal Navigation, and Vessels of the like dimensions, may be constructed, not only to Navigate the Canal, but Coast-ways, and to England, or Scotland, as occasion shall require, and thereby save the trouble, expence, delay, loss of measure, risk of embezzlement, and wet weather, in shipping, and reshipping, at the entrance of the Canal. I will therefore propose the Locks to be 16 Feet by 80 Feet clear pool, and some of them in convenient places, constructed so, that the regulating Water may be made use of, to the advantage of different branches of Manufacture, in which Machinery is serviceable. And in the Aqueducts and Tunnels, as well as Locks intended, I would propose, that Bricks shou'd be more generally made use of, than they have hitherto been, in those already executed. The Canal to be twenty-one Feet in the bottom, and 6 Feet deep of Water, with such convenient passing places as shall be found necessary. The Banks (with a tract way 16 Feet wide,) where raised above Soil, and in the Bog, to slope or batter 5 Feet for 3 Feet in altitude, and in general as four to three. The Canals of Partition, I would propose making 30 Feet in the bottom, and 7 Feet deep of Water, that they may thereby answer all the purposes of extensive Reservoirs. The Tunnel for passing the Hill of Downings, to be the same in the clear as the Locks, the Arch a Semi circle, and to spring nine Feet from the bottom of the Canal.

AN

A N
E S T I M A T E

O F T H E

EXPENCE of making the CANAL and RIVERS Navigable,
agreeable to the foregoing Propositions.

As I look upon the Bog of Allen of no value in this estimate, there will be wanting only Ground for the Canal, on the Lands of Water's-town, Wood of Allen, Lullymore, Killcomber, the Valley of Figule River, Philip's-town, Nockballyboy, Ballycommon, Ballyteague, and Tullamore, in all about 142 A. 0 R. 30 P. Plantation measure, of which great part being very indifferent Soil, I think it valued high at 20 £ per Acre, — — —	2843	15	0
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There will be some Ground wanting for Harbours, contiguous to the high Roads, and for passing places, exclusive of those that may be made in the Bog, for which shall allow 15 A. at 20 £ per Acre, — — —	300	0	0
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The carrying the Canal through the Bog, from the Hill of Downings to Tullamore, being a tract of twenty-four Miles three Quarters, by the nearest computation will cost (Locks and Bridges excepted,) 1350 £ per Mile, — — —	33412	10	0
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To 85500 Cube Yards of digging, and banking, on the Lands of Water's-town, at 3 d . per Yard, — — —	1068	15	0
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To piercing, vaulting, and carrying the Level through the Hill of Downings, — — — — — — — — —	6974	0	0
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To 41034 Cube Yards of digging, and banking, on the Lands of Osber's-town, Sallin's, and Cardiff's-town, at 4 d . per Yard, — — — — — — — — —	683	18	0
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Carried forward,	45282	18	0
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A REPORT on the Practicability, &c

	£.	s.	d.
Brought forward, — — — — —	45282	18	0
To 42450 Cube yards of digging and banking on Barren- rath level, at 3d. per Yard, — — — — —	530	12	6
To 3725 Cube Yards of digging, and banking, on the Hill of Ardclough, at 6d. per Yard, — — — — —	93	2	6
To 25080 Cube Yards of digging, and banking on Hazle- Hatch Level, at 4d. per Yard, — — — — —	418	0	0
To carrying the Canal through the Hill of Goller's-stown,	1460	0	0
To 25 Locks, (exclusive of what is already built,) three of them double, and at an average will cost 730£ each,	18250	0	0
To an additional pair of Gates for the Lock at Clo- naughles, — — — — —	440	0	0
To 6 pair of Gates for the three Locks already erected, at 60£ per Lock, — — — — —	180	0	0
To an Aqueduct Bridge in passing the River Liffey, and an over-fall for discharging the surplus Water, with some necessary banking there, and extra Masonry, — —	3450	0	0
To an Aqueduct Bridge in passing the Morrel River, with an over-fall, &c. — — — — —	350	0	0
To removing the Aqueduct over the Little Morrel, —	40	0	0
To bringing five Tunnels down to their respective Levels, at 10£ per, — — — — —	50	0	0
To 10 small Tunnels, at 15£ per, — — — — —	150	0	0
To 6 Bridges for the publick Roads, at 100£ per, —	600	0	0
Carried forward,	71294	13	0
To			

Of the GRAND-CANAL.

21

	£.	s.	d.
Brought forward, — — — — —	71294	13	0
To 20 Bridges for By-Roads, and to preserve a communication between those Lands that are severed by the Canal, at 40£ per, — — — — —	800	0	0
To some necessary banking and Masonry in a Valley on the Lands of Ballyfarmot, and that of Blue-Bell River, }	364	0	0
To cleansing the Bottom, repairing the Banks, making the Tract-way, and some necessary digging in divers parts, 17 Miles, at 30£ per Mile, — — — — —	510	0	0
Total from Dublin to Tullamore,	72968	13	0
I have been very exact in computing the expence that would attend making the Maiden, and Brusna Rivers Navigable, from Tullamore to the River Shannon, for Vessels of equal draught with those proposed to ply upon the Canal, and do find, upon the nicest inspection of their present state, and calculating the cost of Works necessary for that purpose, my general estimate to be —	27400	0	0
Total from Dublin to the River Shannon,	100368	13	0
The Collateral Cuts from the Canal, to the Rivers Barrow and Blackwood, — — — — —	6500	0	0
The Cut from the Canal, to the River Boyne, to terminate at the high Road near Edenderry, — — —	5000	0	0
The Cut to John's-town, with a Harbour for Vessels, and a Shuttle for receiving Water from the Morrel River, exclusive of Ground, — — — — —	1900	0	0
To unforeseen accidents, Engines and Utensils, — —	10000	0	0
Total from Dublin to the Rivers Shannon, Barrow and Boyne, and to John's-town, — — —	123768	13	0

A Division

A D I V I S I O N Of the foregoing E S T I M A T E:

To which is prefixed,

The TIME in which the several PARTS may respectively
be effected.

	Length				Sums necessary.			Time necessary. Working Months.
	M.	F.	P.	Y.	£.	s.	d.	
From Dublin to Ballykealy Lock at the Great Quarries, — — — — —	5	1	21	3	9034	0	0	12
From Ballykealy Lock to the Great Morrel River, — — — — —	6	6	25	1	3373	3	0	5
From the Great Morrel to the Blackwood River in the Bog of Allen, — — — —	7	3	10	6	16565	0	0	18
From the Blackwood River to the junction of the Grand Canal with that to the Boyn, including the same, — — — — —	8	7	23	5	13125	0	0	18
From the junction of the Grand Canal with the Canal to the Boyn, to the center of the low Level in Kilcomber Bog, including the Canals to the Rivers Barrow and Blackwood,	11	2	23	4	13605	0	0	16
From center of low Level to Tullamore, —	14	4	30	4	28766	10	0	24

Unforeseen Accidents, &c. as in the Estimate at large.

		M.	F.	P.	Y.
The length of Navigation.	will be { From Dublin to Tullamore, —	43	5	29	3
	{ From Tullamore to the Shannon, —	18	6	19	0
	{ From Dublin to the Shannon, —	61	4	8	3

Errors excepted.

N. B. In making these Estimates, the Work is suppos'd to be carry'd on without intermission, in the most speedy and effectual manner.

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2817 2818

To which the

Understood. Accidents, etc. as in the Estimate at
last.

7 3 5 11

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Errors accepted.

N. B. In making these statements the Work is supposed to be carried on without interruption in the most speedy and efficient manner.

THE EXPENCE

OF COMPLEATING the CANAL

Further considered.

BY the foregoing Estimates it appears, that £123768 13s. will be wanting to compleat the proposed Navigation in 93 working Months; yet that does not imply that such a Sum must be raised and expended by the Proprietors, before any advantage will arise to them and the Publick, from so much of it as may be annually finished. This matter, as it merits particular attention, I shall endeavour to elucidate, by shewing how far one part may aid, in carrying the others into execution. And though a computation of the Profits, which must follow the accomplishment of this extensive undertaking, can only be founded on probability, I shall estimate them so low, that none can doubt of their far exceeding my imagination.

Advantage will arise from what is annually finished.

One part aid in carrying the other into execution.

THE first thing to be considered is the Tunnage, or Lock Duty, which can only be fix'd by calculating the probable quantity of Goods that may pass upon the Canal, as it must be adequate to the Sum expended, and which I shall suppose to be £124000, and the length of Navigation only 61 Miles. [As in this Calculation I shall not include the Collateral Canals to the Barrow and Boyn, though the Trade by them, and from the intermediate Country, I am firmly of opinion, will do much more than double this Estimate.] Then if two Vessels of 60 Tuns burthen each, pass per Day, that is one each way, subject to a Tunnage of 14d. per Mile per Tun, that would produce per Week of six Days £274 10s. and 14274£ per Annum, which after allowing 1874£ for Repairs, and expence of collecting, &c. gives 10 per Cent. for the capital to be expended; nor can this Tunnage be thought exorbitant, when it is considered how great the saving will be in the price of Carriage.

Tunnage, or Lock Duty adequate to the Sum expended.

Amount of probable Tunnage.

The

A REPORT on the Practicability, &c.

The present lowest price of Carriage to Banagher is } £. s. d.
 2s. 4d. per Cl. which is per Tun of 2000lb. } 2 6 8

Great saving
in the price of
Carriage.

By the Canal it cannot exceed { Tunnage 7s. 9d. } 0 12 11
 { Freightage 5s. 2d. }

Here we find a saving in the Carriage of one Tun in about 62 Miles, of £1 13s. 9d. which, in some articles sent from Dublin to that quarter, would reduce the price to the consumers, upwards of 40 per Cent. But though I have supposed the Tunnage to be 14d. per Mile, yet there are many articles will pass by the Canal in great quantities, that will not bear so high a Duty, and which I do imagine, (to make the Benefits arising from the Navigation more general and diffusive,) will be rated much lower; for instance, Lime, Bricks, Stone, Flag and Slate, which I shall suppose to pay only one half-penny per Tun, Fuel one Farthing per Tun, per Mile, and Dung, Marl and Gravel for Manure, exempt from Tunnage. These articles I did not at all consider in the supposition of two Boats passing per Day, as they will find, in my opinion, more than sufficient employment in the Carriage of Corn, Malt, Flour, Hides, Butter, Cheese, Tallow, Linen, Wool, Yarn, Groceries of all sorts, Deal, Balk, Plank, Salt, Iron, &c. &c. But whether this Tunnage be too great, or insufficient, is a point to be settled by the Proprietors; however, as it will answer my purpose in what follows, I shall, without considering that matter further, proceed to the performance of what I have promised.

Articles rated
lower.

Articles sup-
posed to pass
by the Canal,
and that will
bear a high
Duty.

The rate of
Tunnage to be
settled by the
Proprietors.

Sum necessary
raised by Sub-
scription.

THE Sum necessary for completing the Canal is, as already observed, 124000£ which I shall suppose to be divided into six hundred and twenty Shares, of 200£ each, and raised by Subscription: The Subscribers to be incorporated, and such securities and conveniencies provided for them by Act of Parliament, as are customary in such undertakings: And that the Money be advanced by the Subscribers as it shall be wanted.

I do by no means offer this as the only Plan fit to be adopted; though it may appear eligible to many, as the Shares are small, and the Payments would be light and easy. But whether the property be in any number of Gentlemen, or whether the City of

Of the GRAND-CANAL.

of Dublin undertake the whole, without any private aid by Subscription, does not reduce the Sum necessary for its completion, nor make the least difference in the following Calculation.

In the Year, 1771.

I shall suppose 10 per Cent. advanced by the Subscribers, which of 124000, is ————— 12400 0 0

In the Year, 1772.

They are again call'd upon for 5 per Cent. ————— 6200 0 0

This Year the Canal is perfected from Dublin to the great Morrel river. —————

In the Year, 1773.

We have an open Navigation of 12 Miles, and the Sum of £6192 17s. in hand to proceed with. And as I would propose, for several Reasons, completing the Canal across the River Liffy to Aughpadien, before we commence in the Hill of Downings, there will be no further advance necessary this Year. — — — — —

In the Year, 1774.

The Proprietors are called upon for 5 per Cent. ————— 6200 0 0

To this we have to add the Profits which have arisen from a 12 Mile Navigation, viz. (from Dublin to the Morrel river,) in the Year, 1773, and which I think estimated low, at ————— 3000 0 0

D 2

Thus

A REPORT on the Practicability, &c.

Thus we have 9200*£* for the continuation of the work through the Hill of Downings to the Bog of Allen; and though it may not be sufficient for that purpose, yet before it be expended, we shall have at least nine Months revenue of our 12 Miles, and with which I shall this Year suppose the Navigation compleatly finished to the Bog of Allen. — — — — —

£. s. d. £. s. d.

2250 0 0

N. B. I have estimated the Profits arising from the first 12 Miles, at 3000*£* per Annum; but should the Proprietors possess themselves of ground convenient for opening Quarries at Gollerstown, and become the carriers for a time, they would, besides giving a good example, clear by the sale of Stone and Lime in Dublin, at least 2000*£* the first year.

In the Year, 1775.

We have an open Navigation of 19 Miles to the Bog of Allen, and 1077 17*s.* unexpended. I shall suppose the Proprietors this year to advance 5 per Cent. — — — — —

— — — 6200 0 0

In the Year, 1776.

The Proprietors are again call'd upon for 5 per Cent. — — — — —

— — — 6200 0 0

This year the Canal being perfected and opened to Edenderry, we have a Navigation of 28 Miles, and remaining in Hand, 1352 17*s.* to which we have to add the amount of Tunnage collected on the Canal from Dublin to the Bog of Allen, in the years 1775 and 1776, (three months of 1774 being allow'd for accidental stoppages,) which I cannot estimate at less than 4000*£* per Annum. — — — — —

8000 0 0

In

Of the GRAND-CANAL.

29

In the Year, 1777.

£. s. d. £. s. d.

We have £8352 17s. unexpended which is sufficient for the continuation of the Canal this year, without calling upon the Proprietors. — —

In the Year, 1778.

The Proprietors advance 5 per Cent. — — — — — 6200 0 0

I cannot suppose the 28 Miles from Dublin to Edenderry, to produce less in the year 1777, than — } 5000 0 0

This year the Canal is finished to the River Barrow.

In the Year, 1779.

We have an open Navigation 39½ Miles, and the Sum of £5947 17s. to proceed with. Any further advance by the Proprietors will be unnecessary this year.

In the Year, 1780.

The Proprietors are call'd upon for 5 per Cent. — — — — — 6200 0 0

Which with the revenue of the open Navigation in 1779 amounting to (I shall suppose only) } 6000 0 0
6000£ will be sufficient for this year.

In the Year, 1781,

The Proprietors advance 5 per Cent. — — — — — 6200 0 0

And having 6000£ to receive from the 39½ Miles, before mentioned, for the year 1780, we shall this year compleat the Canal to Tullamore, and have £1581 7s. unexpended. } 6000 0 0

Total

A REPORT on the Practicability, &c.

	£.	s.	d.
Total advanced by the Proprietors in ten Years, 45 per Cent.	55800	0	0
Total Profits arising from the Canal while executing from Dublin to Tullamore, — — — — —	30250	0	0
Total expended in compleating the Grand Canal from Dub- lin to Tullamore, and the Collateral Canals to the Rivers Barrow and Boyne, in ten Years, — — — — —	84468	13	0
Remains unexpended, — — — — —	1581	7	8
To which add the Revenue of the Canal for the Year 1781,	6000	0	0
And at the end of ten Years we shall have an open Navi- gation 54½ Miles, and in hand for the further continuation of the Work, — — — — —	7581	7	0

N. B. No allowance is here made for contingencies, however that cannot exceed one per Cent. in the several Sums advanced by the Proprietors.

It is, I presume, unnecessary to continue this Estimate further, for if the Canal from Dublin to Tullamore, with the Collateral Cuts to the Barrow and Boyne are but perfected, there can be no doubt of having an annual Revenue from them, much greater than can with propriety be expended in compleating the Navigation to the River Shannon, in at most three Years. And it is to me manifest, when that desirable communication is effected, that the Proprietors, after dividing 10 per Cent. per Annum, will have a redundancy, sufficient to extend the sweets of Inland Navigation, to the most distant and remote parts of the Kingdom, and thereby not only increase their own fortunes, but by facilitating the speedy carrying on of Trade, they open, as it were, the fountains of Commerce and Agriculture, from which only opulency can spring to this, or any other civilized Nation.

AND

Of the GRAND-CANAL.

31

AND though many will at first think a progrefive method, fuch as I have propofed, of proceeding with the work, too tedious, yet, upon confideration, they will be certain, as I am, that it is the moft regular and advantageous, as well to the Publick, as to the Proprietors; for it is not always the greatness of the Sum expended, that produces the profit, or the number of Hands employed, that occasions a speedy completion.

I am,

My Lord,

And Gentlemen,

With due deference,

February the 21st, 1771.

Your most obedient Servant,

JOHN TRAIL

OF THE GRAND-CANAL

And though many will at first think a projective matter, which has
been proposed, of proceeding with the work, to which we have been
now, they will be certain, as I am, that it is the most regular and ad-
vantageous as well to the Publick, as to the Proprietors, for it is not only
the interest of the State, but of the Proprietors, that the work be
done at this time, that contains a happy completion.

I am,

My Lord,

And Gentlemen,

With due respects

Your most obedient servant,

JOHN TRENKLE

A P P E N D I X.

THE short time allow'd for making out my Report, laid me under the necessity of omitting some matters of the greatest moment, such as the method of supplying the Canal with Water, and thoughts with regard to its Termination and Communication with the River Liffy. These particulars only, I purposed as a Subject for a short Supplement, but this Supplement, I now find myself, in some degree, obliged to extend beyond its first intended limits. For on the foregoing Papers and Drawings, to which in some places they refer, being perused by an honourable Gentleman, (whose attachment to his native country, makes it no way surprising to find him exerting his interest in favour of a Scheme, so apparently calculated for the general good of this Kingdom, and consequently for the honour, and mutual benefit of every part of the British Empire,) and finding them to differ in some particulars, from a Report on the same Subject, presented a few weeks before, to the Navigation Board, by Mr. Vallancey, he was pleased to favour me with a Copy thereof, which I have read over with attention. And seeing that our Reports and Opinions differ, not in matters trivial and unworthy of notice, but in those of the greatest consequence, even such as concern the success of this great national Work; it is necessary for your satisfaction, and of those who mean to embark in so extensive an undertaking, to have every point that will admit of doubt, fully discussed and properly settled.

Preparative to such an enquiry, I have, at the request of some Gentlemen, transcribed such Paragraphs of Mr. Vallancey's Report, as any way concern the completion of the Canal, and have, on an opposite Column, given my thoughts on each of them respectively, as the most ready and explicit manner of shewing, wherein our opinions, representations, and estimates, correspond or disagree.

Some matters in which a very considerable difference have arisen, may be adjusted by any Person, without either theoretick or practical knowledge; but other points there are, which require greater skill and experience to determine. Let therefore the Gentlemen who are interested in this arduous enterprise, be upon their Guard, and throw off attachments and prejudices in favour of any person or opinion, and be ware of what they take for granted from the ignorant and unexperienced, nor acquiesce in speculation, without demonstration

monstration deduced from uncontrovertible experiments: Then they may assure themselves of success, greatly to their own advantage, and the benefit of Ireland.

Too much light cannot be thrown upon a subject of such national concern, nor should advice that would tend to remove any difficulties, arising from a diversity of opinions, be thought too expensive in procuring. Let therefore Mr. Smeton, (an Engineer whose intimacy with the various branches of Science, renders him an ornament to his country, and whose practice and experience places him at the head of his profession,) or Mr. Brindley, be invited to view the country, and review the several Reports: Then, (wheresoever I may be,) if living, I shall be ready further to explain my design, and vindicate to the utmost of my abilities, every proposition I have made; but with regard to practical methods, that I shall leave to the ingenuity of the person who shall be appointed to superintend the execution. At the same time, I must premise that I will enter into no altercation with any Engineer I have yet met in this kingdom; as either of the above mentioned gentlemen, will, I am confident, settle every matter of dispute, to the general satisfaction of the Publick and the Proprietors, as they will not estimate to deceive, or draw into Schemes, embarras'd with difficulties, those who repose confidence in them, nor condemn what they find judicious, because it was proposed by another, but will faithfully represent things as they really find them.

ABSTRACTS

A B S T R A C T S

FROM

MR. VALLANCEY'S REPORT.

BETWEEN the City Bafon and the Liffey there are many small Brooks, such as those of the Murrell, Miltown, Clondalkin, &c. &c. which being of little Consequence, I shall begin with the River Liffey, as the first great Object of this kind which presents itself to our View. It was proposed by Mr. Omer, that the Canal should pass this River at Waterstown, between Clain and Newbridge, it is in this Place One Hundred Feet broad and Ten Feet deep in the dryest Seasons, and in Floods it rises Twelve or Fourteen Feet more,

but

SOME of these Brooks I think of consequence, in particular the great Morrell, as the disposing of it properly, will require skill and a considerable expence: I have intimated only that I propose passing it on Arches.

To differ in opinion with Mr. Vallancey, concerning the propriety of any proposition, would give me no kind of uneasiness; but to find myself obliged, for the sake of truth, and in my own vindication, (*point blank*;) to contradict any thing asserted by a Gentleman, is to me exceedingly disagreeable. However, I am here under the necessity of saying, that, where the Canal is proposed to pass, (see Fig. 1st. Plate 2d.) the River is 92 feet broad, and on the first day of September last, though far from being a very dry season, it was only 3 feet depth of Water; and the marks shewn me by inhabitants of that part, to which the highest Floods in their memory rose, were about 7 Feet 6 Inches above the then Surface.

E 2

but this being an improper Place, for this and other Reasons, I have proposed to cross it about Two Hundred Yards higher up the Stream, where it is only Three Feet deep.

THE Liffey is one of those Mountainous Rivers which are extremely difficult to be made Navigable on account of their Rapidity, and the immense Quantity of Gravel brought down with every Flood.

THE Communication of the Canal with this River, down Stream from Waterstown, is of no Consequence, the adjacent Country being chiefly possessed by Gentlemen's Seats, and Grazing Farmers, and the Town of Clain is well provided with Fuel from the neighbouring Bogs. But from Waterstown, up Stream, towards Kilcullen, its communication would be of the utmost importance, and to the City of Dublin in particular; from the very great Supply of Corn and Potatoes which may be conveyed by Water, by a Cut to be made from Kilcullen to the Grand Canal at Sallance Bridge. The Fall of this Cut is about thirty Feet, and

THIS more proper place for crossing, is at the Ford, which upon enquiry, (since the publication of Mr. Vallancey's Report,) I find was the place where Mr. Omer originally intended to pass this River, by a Penlock, and to which, the ground was purchased and paid for; but he wisely, in my humble opinion, altering his mind, laid out the Line in its present direction: The propriety of his second thought I shall more fully consider, when I come to another Paragraph on the same subject.

THE rapid Floods of this River, and the quantity of Gravel brought down by them, were sufficient inducements, for Mr. Omer to drop his Scheme of passing at the Ford.

A Communication between the Canal and the River Liffy, up, or down stream, being a matter foreign to my Orders, I neither survey'd, nor took the Levels of any Tract for that purpose: Yet I doubt not but such a Cut as is here proposed, is practicable, and very probable, would turn out exceedingly advantageous to the City of Dublin, and to that part of the Country. But with regard to the Estimate, I am of opinion Mr. Vallancey has, through haste, omitted some costly articles; for, allowing the Tract to be by him accurately described, I shall think it exceeding reasonable, if executed for 16000*l*.

and the Distance being Nine Miles, will at a Medium, require about Nine Feet Sinking, and four Locks; so that the utmost Expence to compleat this Cut, cannot amount to more than 8000*l*. To do any thing more on this River, either above, or below the Canal, would be so much Money thrown away, as it could not possibly tend to any publick Advantage.

THE next River the Canal meets, is that of Blackwood, near the Togher of Graig, on the Borders of the Bog of Allen: This River is situated in the highest Ground through which the Canal is to pass, it is therefore the point of Partition, and from thence the four great Trunks of the Canal, extending to the Shannon, to Dublin, to the Rivers Barrow, and Boyne, are to be supplied with Water; it was therefore necessary to examine if the River afforded a sufficient Quantity for such a Navigation, as may be supposed to be carried through the several Parts of the Country, was the Work compleated. I measured it at the Time of its lowest Water, and found its mean Depth Four Feet, its Breadth Nine Feet, and its Velocity Ten Feet, in Fifty-five Seconds, which gives 31,104,000 Cubic Feet per Day of 24 Hours, or 373,700 Tons per Hour.

Now

I am apprehensive that some very great mistake hath been committed in this Calculation. For supposing the Depth of this River to be four Feet, the Breadth nine Feet, and the Velocity ten Feet, in fifty-five Seconds, we shall find it turn out as follows,

$$4 \times 9 = 36 \times 10 = 360 \text{ Cubic Feet in 55"}$$

$$360 \times 3600 = 1296000 \div 55 \text{ we have then } 23563,1099 \frac{1}{5} \text{ Cubic Feet, Inches and}$$

and Parts, which is upwards of 699 Tons, 1 Hoghead and 57 Gallons, given by this River in 3600^l or one Hour.

N. B. The Ton contains 4 Hogheads, each Hoghead 63 Gallons, and each Gallon 231 Cubic Inches.

To make the number even, I shall suppose the River to give 23564 Cubic Feet per Hour, that will be per Day, of 24 Hours, 565,536.

Now the Chambers of Mr. Omer's Locks, are in general 132 Feet long, 21 Feet wide, and 9 Feet fall, so that supposing the Lock to be filled for one Boat only,

THE Chambers of Mr. Omer's Locks are in general 132 Feet long, by 21 Feet wide, and as the fall of the Lock at Clonaughles is 13 Feet, we must calculate by it; the same quantity of Water being necessary for the supply of the Navigation, as if every Lock had the like Fall, it being here proposed, to be entirely drawn from the Canal of Partition.

SUPPOSE then a Lock to be fill'd for every Boat,

(and two or more may pass at a time,)

each Boat that passes will expend 24,948 Cubic Feet of Water,

(the Lock is here supposed to be filled and emptied for every Boat, whereas

(for if two Boats of burthen and size pass with one Lock-full, unless they meet in the Canal of Partition, there will be the same expence of Water, as if the Lock had been fill'd for each of them respectively,) each Boat that passes will expend 36,036 Cubic Feet of Water.

THE Lock must be fill'd and emptied for every Boat, except (as I already observed,) when two Boats meet in the Canal of Partition.

THIS

whereas there being 6 Feet Water constantly in the Chamber, the Quantity drawn down to fill the Lock, will be only $132 \times 9 \times 3$ feet, which is in reality but one third of the Quantity here specified,)

and

THIS part of Mr. Vallancey's Calculation, is unworthy of further Notice, and yet I cannot pass it by, (least it might be thought an improper omission,) without observing, that, though there be 6 feet water in the Chamber, there is also 6 feet water on the upper gates, consequently, the fall is the same at the Breast of a Lock when the Canal is navigable, as it is before the water is let in, I find it asserted, that, *the Quantity drawn down to fill the Lock will be only $132 \times 9 \times 3$ viz. 3564 Cubic feet, which is in reality but $\frac{1}{3}$ (tho' Mr. Vallancey is pleased to call it $\frac{1}{3}$ of 24,948. Now I cannot conceive how 3564 Cubic feet can be made to occupy an equal space with 24,948 Cubic feet, unless it be by rarefaction, then indeed one foot will be sufficient; and if the Vapour shall be found incompressible; or equal in specific gravity with water in its natural state, it must be allow'd that every purpose will be fully answered thereby.*

A Review of this nature, is a task to which I have an utter aversion, especially, when in a subject so simple, I am under the necessity of pointing at so many errors, and, (I cannot help saying) inconsistent assertions. Nor did I imagine that in this undertaking, there would be so much occasion for my pen, or it certainly should have gone into other hands; however, having got so far, I will endeavour to reach the end, but am in hopes of being excused for using all possible Brevity in my remarks.

THE

and supposing one to pass at the same Instant on each Branch, they will expend 99,792 Cubic Feet of Water, and allowing 30 Boats to come up each Branch per Day, and as many to go down, the Consumption of Water for these 60 Boats on each Branch multiplied by 4, will be 5,987,520 Cubic Feet, which is the Quantity we have here supposed to be drawn daily from the Reservoir at the Point of Partition, which subtracted from 31,104,000

leaves 25,116,480 Feet, or 7242,64 Tons per Day, for Leakage, Succage, Waste, Evaporations, Bleaching Greens, Mills, &c. &c. But as the whole Quantity of Water to be drawn from the Reservoir is 5,987,520 Feet daily, consequently one fourth of that Number may be allowed to the Branch extending to Dublin, to which if we add the surplus Water, (supposing it all turned towards the City) we shall have 26,613,360 Feet, or 7673,98 Tons for the Quantity the City of Dublin may obtain every Twenty-four Hours for their Use,

THE Blackwood River according to the dimensions and velocity given of it, by Mr. Vallancey, produces (as hath been already shewn,) per day of 24 hours. } Cubic Feet. 565,536

One Boat passing from the Canal of Partition, — — —	} Will expend	Cubic Feet.
Four Boats from the Canal of Partition,		36,036
Thirty Boats on each Branch up and down,		144,144
		8,648,640

Total expence of water per day, — 8,648,640

Total supply of water per day, — 565,536

So that by this scheme and calculation, we find the Blackwood river insufficient for the supply of the Navigation } 8,083,104

Then where is the 25,116,480 Cubic feet per day, for Leakage, Soakage, Waste, Evaporations, Bleaching Greens, Mills. &c. &c.?

Or 26,613,360 Feet for the use of the City of Dublin?

BUT notwithstanding the great deficiency by Mr. Vallancey's calculation, I will endeavour to shew, that there is Water in abundance for the greatest trade that can be supposed to be carried on by this Navigation, and to answer every necessary purpose.

THE

APPENDIX

require but two Locks full the utmost
 expense of Water in passing these no
 Boats (the Chambers of the Locks
 being 80 feet long, 16 feet wide, and the
 fall 10 feet) will be 21,000 Cubic feet
 but as the Lock at Clonsilla is 132
 feet long, and fall 13 feet, there will be
 an additional supply necessary for it of
 44,720 Cubic Feet of Water per day.
 Now by several experiments made in the
 different seasons, I found the two Rivers
 called the Murrells, to give 748,000 Cu-
 bic feet per day, and the other are o-
 ther sources, from which we could draw
 a much greater quantity for the supply of
 that part of the Navigation; yet as this
 can be obtained without trouble, and at
 a very inconsiderable expense, I think
 it entirely needless to dwell longer upon
 the subject. However, in order to
 make this matter as clear as possible,
 I shall state it thus.

Cubic Feet	
The Blackwood River gives per	day of 24 hours. —
748,000	
Cubic Feet	
1st part of the Canal, which	is and depending on the
Blackwood River for a sup-	ply, will give for the Bal-
ance of 20 Boats per day,	—
21,000	
For Leakage, which I reckon	
equal to the expense of 2	Boats per day, —
42,000	
For regulating Water, —	
43,720	
As the Canal will be drawn	
deep in ground through the	soil, we shall rather gain
than lose in this part, than	by leakage.

I measured the Black wood River, about $\frac{1}{4}$ Mile down stream, from the place where it is intersected by the Canal, and after some weeks fair weather, when it turned out much more inconsiderable, than on a former tryal I found its Depth $4\frac{1}{2}$ Feet, Breadth 8 Feet, and Velocity 10 Feet, in 40 Seconds.

$$\text{So that } 4\frac{1}{2} \times 8 = 36 \times 10 = 360$$

$$360 \times 3,600 = 1,296,00 \div 40$$

We have 32,400 Cubic Feet given by this River per hour, and 777,600 Cubic Feet per day of 24 hours.

It now remains to examine what quantity will be necessary for the supply of the Canal, but first I shall premise, that, as I have proposed carrying the collateral Cuts to the Boyne and Barrow on a dead Level, there will be no Water drawn from either of the Canals of Partition, by the Trade between those Rivers, let it be ever so considerable; nor will the communication between them and the River Shannon, depend upon the Blackwood River for a supply. I therefore think, it cannot, with the least propriety, be imagined, that more than * 20 Boats will pass this Canal of Partition per day, and as each Boat can

* THE Tonage, or Lock duty of 20 Boats per day, supposing them to come equally from the Shannon, Barrow, and Boyne, to Dublin, with only half Loading, will amount to upwards of 40,000 per Annum.

A P P E N D I X.

43

Total expended per day, — 388,800

Remains — — — — 388,800

To which add the Morrells, — — 748,000

Then, that part of the Canal
from the Blackwood River to
Dublin, will have for the
Passage of 20 Boats per day, } 720,720

For Leakage, equal to 5 Boats
per day, — — — — } 180,180

For Soakage and regulating wa-
ter, — — — — } 235,900

And for contingencies, we shall
have in the Canal of Parti-
on, (by its extra Dimensi-
ons,) a reserve of — — } 2,705,664

We have now to enquire, from
whence a sufficiency of Water can be
brought to the second Point of Par-
tage, near Philipstown, for the Supply
of the Navigation from Figuille River,
to Tullamore, for which purpose, there
will be wanting, (allowing the same
number of Boats to pass this Canal of
Partition, as was supposed in the fore-
going Calculation, to pass the first.)
512,000 Cubic Feet per day.

Now the principal Object I have in
view for this Supply, is Figuille River,
or River Lyons, which I found (at a
time when thought low, by the Inha-
bitants of that Quarter,) nearly able
to answer double the demand, I there-
fore rest satisfy'd, that this part of the
Navigation will have a full and am-
ple Supply, especially as other means
are apparent, by which a greater quan-
tity

and if this be found insufficient, the Rivulets of Derrymullen and of Graig, may be turned into it, and they afford at least double that Quantity. They empty themselves into Blackwood River, a little below the Place at which I measured its Velocity and consequently are not included in this Calculation.

THE Blackwood River takes its Name from the Town-land in which it rises, near the Togher of Graig, one Stream also comes from the Bog of Cloghabane, and both united run by Ballyteague Castle, and Cloncumber in the great Bog of Allen, through Rathangan, below which it falls into the Barrow, about three Miles above Munster-even: From its Spring Head to its Mouth, it has worn its Channel through the Bog to the hard Ground, so that when this Bog shall be drained, this River must keep its Level; I have been particular on this and the Quantity of Water it yields, because it was formerly urged by the Enemies of the Southeren Line, that the Level could not hold, when the Bog was drained, and that the Quantity was insufficient.

THE Course of this River from the Point of Partion to the Barrow, is through Bog and soft Ground, and being

tity of Water may be collected for the purpose, than the Trade of those parts can possibly require.

THESE two Rivulets do not produce half the Quantity, and are included in my Calculation.

I neither think it consistent with publick utility, or the private advantage of the Proprietors, to run two Navigations

ing the shortest Cut by ten Miles from Dublin, to that Part of the Barrow, from whence the Publick can possibly draw any Advantage, determined me to take this Course for the Junction of the Barrow with the Grand Canal, and which must make a Saving of twenty Pence per Ton, in all Kilkenny Coals sold in Dublin, brought by this Navigation,

By the Description I have given of the Rivers intersecting the Canal, the Course of it has been described; I shall proceed to its present State, and to point out such Defects as will require Amendment.

THE best Route has certainly been taken by Mr. Omer from Dublin to the Commons of Hazle-Hatch, not excepting the great Quarry of Gollerstown.

As

Navigations for several Miles, nearly parallel to each other; where a great and unnecessary expence will be incurred thereby, and from which, general inconveniencies will arise: And I am of opinion, when an actual Survey is taken of the Blackwood River, the Passage by it will be found, not even three Miles shorter, than by the Cuts I have proposed. Therefore without considering other weighty Reasons I have for differing with Mr. Vallancey in this point, the Proprietors are to judge whether it will be adviseable to expend at least 9000*l*. to save that length of Carriage from the Barrow, to the East end, and thereby increase the length of Carriage near twenty Miles to the West end of the Canal. With regard to the advantage, or disadvantage, that may arise to any particular part, or to the Kingdom in general, from any other Cuts or Canals proposed by Mr. Vallancey, I leave entirely to the consideration of the Proprietors, as I am totally unacquainted with them.

In this I do entirely agree with Mr. Vallancey.

Though

A P P E N D I X.

As far as this Quarry, the Excavation is very nearly made, and only requires Locks to be immediately navigable.

but at the Commencement of the Quarry a great Mistake has been committed in the Levels, by placing the upper-fell of Ballykeily Lock, near four Feet below the fell of Old-town Lock, next above it, as expressed in the Profile, and as the Fall at Ballykeily is but ten Feet, this Defect might be remedied by raising the Breast of that Lock, but another Mistake is committed and much more difficult to be rectified, which is that of keeping in the hollow Ground at Hazlebach, having been obliged to Bank in about eighteen Feet in some Places, and in many Places this Bank is not high enough by eight Feet, and in most Places by four Feet, for the Space of a Mile: And in order to gain Earth for raising these Banks, they have sunk the natural Ground on the Out-side, below the Surface three and four Feet, and having neglected to fill up the Bed of the Canal, so as to bring the whole on an Equilibrium, the lateral Pressure of the Water, has forced its way through the Banks, where the Pressure is greatest; this Defect has in some Measure been rectified, by building a dry Wall against the Out-side Banks,—but would be very insufficient, were these Banks raised to their intended Height.

This

THOUGH the excavation of this part be in great forwardness, yet there are, besides Locks, other Works necessary to compleat it.

I found this Mistake to be only two Feet eleven Inches, and have in the Profile expressed it accordingly; however, I do approve of Mr. Vallancey's remedy, as may be seen in my Report.

THE enormity of this Mistake, (if it may be so call'd,) is here greatly exaggerated; for the Banks where they are at present lowest, will not require four Feet additional Altitude, and that for the space of not quite $\frac{1}{4}$ Mile.

I do by no means approve of raising Ground, or making back Drains immediately on the outside of Banks, so circumstanced as these are, and which I think, had they here let alone, and thrown off the Banks, so as to find stuff sufficient for raising them in the Canal, preserving at the same time their proper Slope, the lateral pressure would have been of no consequence, had the Canal been made ever so deep.

But

A P P E N D I X.

This might have been avoided by keeping the Line in the high Ground, on the South Side; the best way to rectify this Mistake is to erect a Lock at Hazlehatch Bridge, to keep the Level as it stands at present at Ballykeily, and to raise the upper-fell of it to the Level of Old-town Lock, next above it, which will Cost 2319*£*. 6*⁄**s*. But if on experiment it be found as cheap to purchase high Ground and to cut a new Line, I beg leave to recommend that Method.

FROM Old-town Lock to Sallance Bridge, the best Line has been pursued, and the Excavation very nearly compleated, the Expence of Digging to be done, not exceeding 1500*£*. But from Sallance Bridge to the Liffy another great Mistake has been committed, apparently for the sake of keeping a Streight Line, for although the natural Ground falls thirteen Feet too low from the Bridge to the Liffey, yet the Ground is digged as if the Canal was to have run into the River; and this I have been informed was Mr. Omer's first Design. I beg leave to ask, where was his Point of Partition in this Space? Where his Reservoir of Water? The Ground is purchased,

BUT I cannot understand, how filling up the Bed of the Canal, can bring the whole to an *Equilibrium*.

I think Mr. Vallancey's method of rectifying this Mistake, by building a Lock at Hazlehatch Bridge, would be exceedingly improper, for the Reasons given in my Report.

Notwithstanding Mr. Omer's great propensity for streight Lines, I cannot help viewing this part of his Work, with a much more favourable Eye, than that, with which Mr. Vallancey is pleased to look down upon it; and though I cannot commend, or pretend to vindicate Mr. Omer's design, yet I am of opinion, that the application of Mr. Vallancey's remedy, would turn out the greater Mistake.

A P P E N D I X.

but as the Distance is not more than a Quarter of a Mile, the Publick will not be very considerable Sufferers by purchasing new Ground; add to this, the place was improper for crossing the Liffey, as I have set forth in the Description of that River.

THE stress of Mr. Vallancey's objection, (if I comprehend him rightly,) lies upon the impropriety of deep digging, where the natural surface of the Ground runs under the Line of Level; and which I do suppose, he condemns upon the same principles, as is (in a former Paragraph) assigned for his disapproving of a part, in some degree similar to this, *viz.* their *having neglected to fill up the Bed of the Canal so as to bring the whole on an Equilibrium*; a doctrine, which I have already said, I do not understand. But here he also says, that this is an improper place to cross the Liffey, and in his *Description of that River*, proposes to pass it *about two hundred Yards higher up the Stream*. Now as an *improper* disposition of this River, might be attended with destructive consequences, I have hereunto annex'd the Plan and Profile of that part, (*see Plate 2d.*) and though I shall not at present, give a particular explanation of the several Figures, yet they may enable Gentlemen, to make a more strict enquiry, for which this Plate is intended.

JOHN TRAIL

F I N I S.

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Fig. 3.



Fig. 4.



Fig. 2.

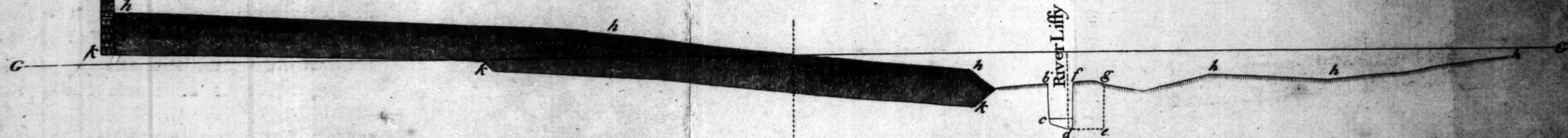


Fig. 1.

